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Concrete septic tanks for farmhouses and



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Concrete Septic Tanks

For Farmhouses and Dwellings in Small Towns



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Concrete Septic Tanks for Farmhouses and Dwellings in Small Towns

Most persons will be surprised to know that recent statistics show many cities are far healthier places in which to live than is the average rural community. The reason for this is that city health authorities enforce regulations compelling the disposal of house wastes in a sanitary manner. Most cities are equipped with sewage systems, and disposal plants where sewage is rendered practically harmless. Small towns and rural communities are not usually so favored. Farmhouse wastes are often thrown out upon the ground in a thoughtless manner, without regard for the possible sickness and death that may result from such practice, not only to persons in the immediate locality, but to others far away. Most epidemics of disease in the city, such as typhoid, scarlet fever and diphtheria, can generally be traced to insanitary conditions on the farm — contaminated water supplied to dairy stock.

Experiments have proved that disease germs have lived through a trip of 90 miles in river water. The New York State Board of Health reports an instance where ignorance on the part of a backwoodsman who was ill from typhoid fever, was the direct and only possible cause of a typhoid epidemic in Plymouth, Pennsylvania, in which more than 1,000 persons were affected and more than 100 died.

Many disease germs are not easily made harmless or destroyed by methods that the average farmer usually adopts for disposing of household wastes. Typhoid germs buried in cultivated soil will possibly be found alive and dangerous three to six months after the time they were so scattered. Other experiments have proved that typhoid germs are not destroyed by the action of rotting bacteria in a cesspool.

House wastes scattered upon the ground or even discharged into a cesspool, seep thru loose soil and eventually contaminate water supply which, in turn, passes germs on to dairy stock, then into milk. Cesspools, if located in firm soils, must be pumped out periodically. In such cases the contents are distributed over the surface of the ground, giving forth vile odors, and the filthy wastes are sooner or later washed into some stream, thus polluting it and spreading infection. If the cesspool is located in sandy or gravelly soil through which the contents may continually seep out, then sooner or later the source of domestic water supply on the farm — the well — will become contaminated.

Modern conveniences of the city dwelling have been extensively adopted for the farmhouse. The kitchen sink, the bath and indoor toilet are too convenient to do without, yet have a penalty attached unless the wastes that are handled by such a system of house plumbing are disposed of in a satisfactory manner. The cesspool should no longer be tolerated. Instead, a sewage disposal system that will be sanitary, convenient for use, easy to maintain and of simple construction, should be substituted. Such a system is represented in the modern septic tank which provides for final disposal of house wastes thru either of two methods that will be described more fully later.

A properly designed septic tank makes use of the process or agencies of Nature. Such a tank should have not fewer than two compartments.

House sewage is discharged into the first of these compartments (sometimes called the sedimentation chamber) where bacteria develop, multiply, and feed on the sewage, so to speak, thus breaking up and changing a portion into relatively harmless compounds. Such processes as occur in this first compartment, however, do not render the sewage entirely harmless. The bacterial process occurring in the first compartment, which must be dark and practically airtight, represents one of two successive stages necessary for sewage purification. The second, which consists of a combination of oxidization, nitrification and filtration, must be performed in the presence of light or air, or both. The order of purification must always be as just indicated, first, the bacterial action; second, aeration and nitrification — never the reverse.

Final disposal may be carried on in either of two ways. Where possible to do so, surface, or broad irrigation is satisfactory, which means discharging the sewage from the septic tank upon the land, where it is allowed to spread over the ground and be acted upon by the sun and certain other bacteria which live in the upper layers or portions of the soil. The plot of ground used for this purpose may be cultivated land or may be an area of waste land. In either case it should be located as far as possible from the source of domestic water supply, this distance never being less than 200 feet. Care should be taken to keep dairy cattle from grazing over the disposal area.

Discharges from the tank should be carried to the disposal field by a tile line having sealed joints and emptying into an open ditch about 12 inches wide and 6 inches deep, with laterals at right angles to it and about 6 feet apart, dug with sufficient grade so that the liquids will spread quickly and evenly over the whole area.

Another method of disposal is frequently practiced. This is called sub-surface irrigation, and consists of discharging the tank contents into lines of 4-inch drain tile laid with open joints from which the fluids leach

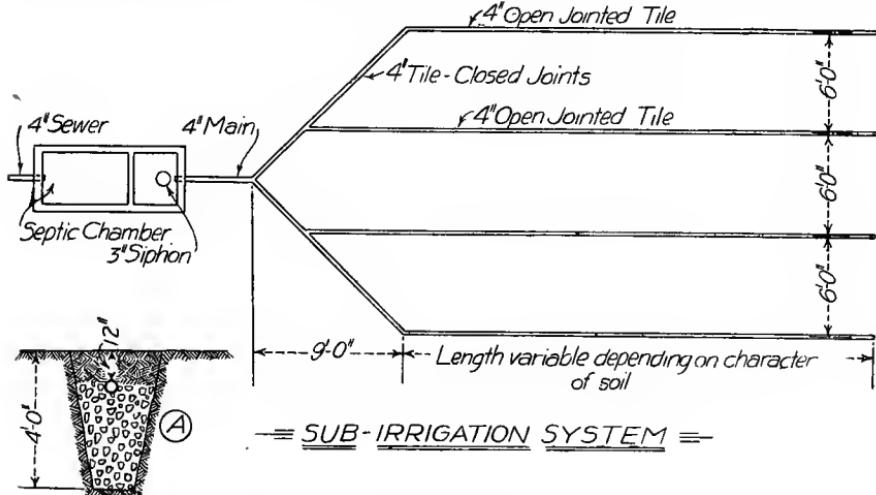


Figure 1. Plan of Septic Tank with Final Disposal System After the Sub-irrigation Method, showing also a section of trench which may sometimes be necessary when tile are laid in tight soil

or filter into the soil. The grade of such a tile line should be not greater than 2 or 3 inches per hundred feet.

To prevent soil from entering the tile line through the open joints, these may be covered with flat stones or pieces of broken tile of larger diameter.

Sub-surface irrigation is in a way similar to broad irrigation, in that the final stage is filtration; the intermediate step, namely, aeration and nitrification, being carried on immediately beneath the surface of the ground instead of on its surface.

Figure 1 illustrates the disposal method by sub-irrigation. Length of drains necessary will be governed by the nature of the soil. If this is loose and sandy, 200 feet is sufficient, although in tight soil it may be necessary to double this length.

Generally speaking, the method of disposal by sub-surface irrigation is best adapted to the single residence. This system usually requires less attention to secure satisfactory operation; furthermore, the sewage is

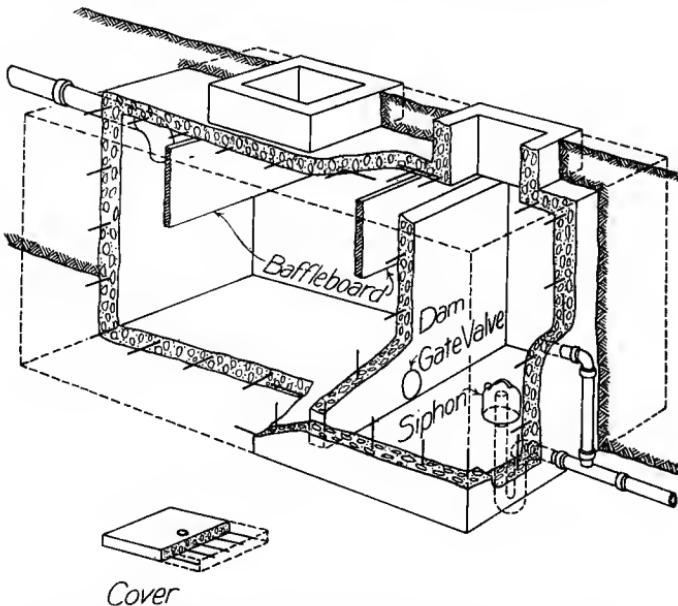


Figure 2. Septic Tank for Use Where Sub-irrigation is Practiced, showing tank interior partly exposed as if a portion of the tank were cut away.

entirely hidden from sight after discharged from the tank, and this is a desirable feature.

Sub-surface irrigation is not well adapted to firm or dense soils. In such cases a plan sometimes adopted is illustrated at "A" (Figure 1); that is, the tile are laid on a gravel or cinder filling in trenches, then covered with about a foot of earth. In heavy clay soils an additional line of tile in the lower portion of trench to drain it is frequently necessary.

The design in Figures 2 and 3, shows a septic tank as it would appear if partly cut away to expose the interior to view, and as if cut in half along a center line following its length. This type will be found to operate

effectively where final disposal is accomplished by sub-surface irrigation. This system once started is self-operating due to the siphon* shown in the second, or right-hand compartment, which at regular intervals empties the contents and discharges them into the line of tile from which the liquids leach out thru joints into the soil. In a tank constructed as shown in the design mentioned, it is very important to use a siphon to empty the second compartment at intervals instead of allowing a continuous outward flow of contents, because of the tendency for drains to become clogged when liquids are constantly trickling through.

The size of tank required for residence use depends upon the quantity of sewage to be handled in the first chamber during a day of 24 hours, therefore, this compartment should be large enough to contain an entire day's flow. This frequently amounts to from 30 to 50 gallons per person per day, so the required capacity can readily be computed from these figures, although it must be remembered that the required depth for the tank should be figured from the top of the concrete baffle wall or partition

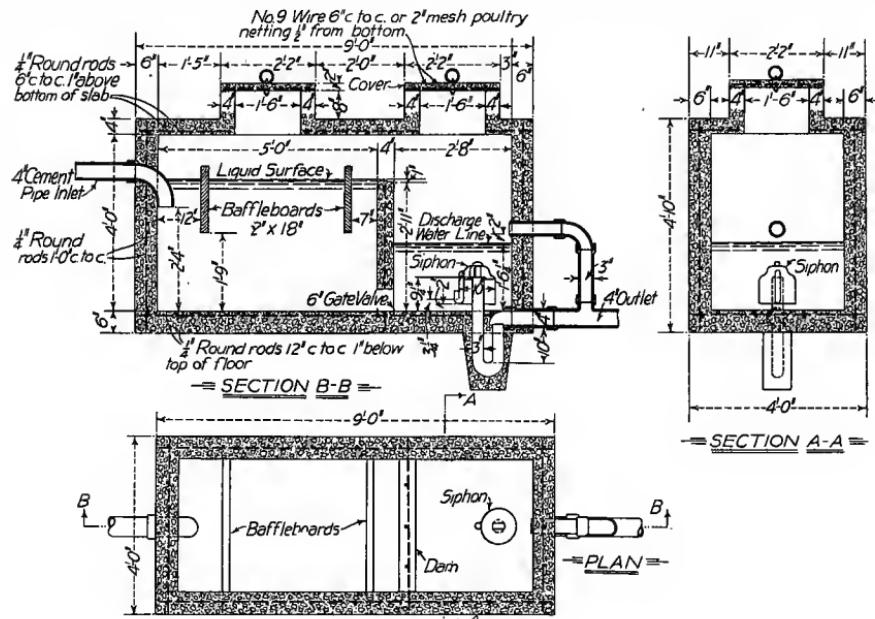


Figure 3. Septic Tank Same as Shown in Figure 2. This shows the construction as if cut away along a center line following its length, also a section of the siphon chamber and a plan of the whole construction.

which separates the first and second compartments. Another point to bear in mind is that the width of the first compartment should be about one-half its length.

*Such siphons are not expensive and can be obtained from any one of the following concerns:

Pacific Flush Tank Co., Chicago.

Merritt & Co., Philadelphia.

The Hendire & Bolthoff Mfg. & Supply Co., Denver.

S. Story & Sons, Cedar Rapids, Iowa.

Where broad irrigation is practiced because of dense soil or where the fall of ground does not make the sub-surface irrigation system practicable, then the design shown in Figures 4 and 5 will be found effective. If the length of first chamber is 3 feet 9 inches, the tank will accommodate the wastes from a household of 6 persons, figuring that an average of 50 gallons of sewage per day for each member must be disposed of. If a family of 8 is to be served, the length "A" should be made 5 feet. It is estimated that one day will be required for a given amount of liquid to pass thru the first compartment, under the baffle and over the weir or partition wall, upon the sand filter.

In both of the designs presented, it will be noticed that baffle boards are shown. These are for the purpose of preventing any disturbance of the scum which forms on the surface of the liquid in the first compartment, because efficient bacterial action is dependent upon keeping this scum motionless and preventing any of it from being carried out of the compartment. These baffles break up eddies and currents caused by the flow coming into the tank and in the first design consist of two 2 by 18-inch boards set in slots formed in the tank walls at the time concrete is placed.

In the second design concrete baffles are shown, as well as three 1 by 6-inch boards so placed at the inlet side of the first compartment that they will break currents from sewage entering the tank. These boards are secured in position by toenailing at the ends to small pieces of lumber set into the tank walls when concrete is placed. Both designs show manholes which permit access to the tanks for cleaning, tho the necessity for this is infrequent.

Septic tanks are best constructed of concrete, which should be mixed in the proportions of 1 sack of Portland cement to 2 cubic feet of coarse sand graded up to $\frac{1}{4}$ inch, to 3 cubic feet of screened gravel or crushed stone, the particles of which vary in size from $\frac{1}{4}$ to $1\frac{1}{2}$ inches. Enough water should be used to produce a mixture of quaky consistency so that the concrete when placed will settle into all parts of the forms when slightly jogged or puddled with a spade or similar tool. Spading assists

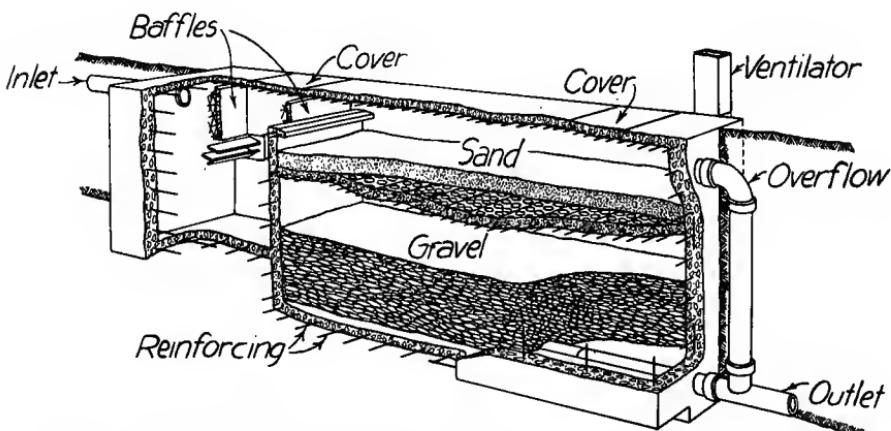


Figure 4. Septic Tank of a Type Adapted for Use Where Final Disposal is Made by Means of Broad Irrigation. This view shows the construction as though partly cut away to expose the interior view.

in removing air bubbles from the concrete and produces a denser mass. Tank walls should be 6 inches thick, reinforced as shown on the drawings.

In Figure 4 concrete baffle walls extend down from the cover slab a distance of about 1 foot 6 inches. These are reinforced by means of $\frac{1}{4}$ -inch round rods spaced 6 inches center to center, both vertically and horizontally. Between the two chambers there is a weir or dividing wall 4 inches thick extending from the floor to within 6 inches of the cover slab. This wall is provided with a lip so that the sewage cannot trickle down the face of the wall but will at once be discharged upon the sand filter. This lip is reinforced by bending the ends of the vertical reinforcing in the weir wall at right angles to it and by one horizontal rod near the edge.

The sand filter is 6 inches deep and $2\frac{1}{2}$ times the length of the first compartment. It is supported by a 3-inch concrete slab, 35 inches wide, divided into three sections, reinforced with $\frac{1}{4}$ -inch round steel rods, and contains a large number of conical openings. These are made in the slab by setting tapered pieces of wood into the concrete before it has had time to harden. When the slabs are placed, these openings are filled with small pebbles to prevent the sand from passing thru to the gravel filter below. In order to simplify the work of building the filter board, a suggestion for another type is shown at the lower right-hand corner of Figure 5. This board is made of 2-inch lumber with gimlet holes drilled as shown. A 3-inch ledge projecting from the side wall serves as a support. The three sections permit easy removal in case it is desired to secure access to the gravel filter.

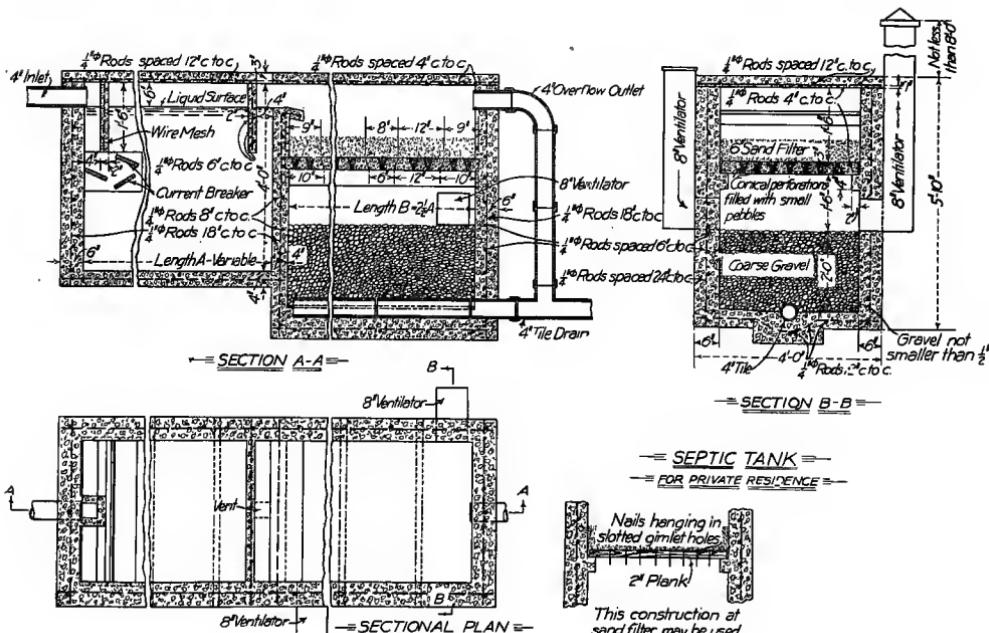


Figure 5. Septic Tank Shown in Figure 4, illustrating the entire construction in section as though cut along a center line following its length, also a section of the filter compartment and plan of the whole structure with sectional view of another method for constructing the sand filter.

To prevent liquids from running along the side walls, two end pieces of the above slab are set into slots, in which clay has previously been daubed to form a tight joint. Clay may be used also to fill the open space between the ends of the slab and the side walls, as the slab is made of less width than the chamber, to permit easy removal.

Perforating this slab causes the filtered sewage to be sprinkled upon the coarse gravel filter below, and as it falls, it passes thru an 18-inch air space which is ventilated by means of air shafts at opposite sides of the structure. A difference of at least 8 feet in the height of these air shafts is advised in order to create as much draft in the upper portion of the gravel filter chamber as possible. A ventilator placed upon the taller side would assist in this respect.

Gravel in the lower filter should not be smaller than one-half inch and is well cleaned and screened before placing, as it is desired that the sewage be thoroughly aerated as it passes downward toward the tile which drains the plant. Air which enters by means of this tile serves to supply ventilation to the gravel bed. If it is desired to make use of the gravel filter feature where the natural fall of ground does not permit draining, the perforated slabs can be omitted, raising the floor of the gravel chamber 1 foot 9 inches. The discharge from such a tank can be distributed over the surface of the ground with no fear that odors will cause a nuisance. (It will be seen that the gravel filter in this plan performs the same service as the gravel in the trench "A," Figure 1.)

The size of reinforcing rods, their spacing and location are all shown on the drawing in such a manner that there need be no doubt as to the features of construction.

To those interested in septic tank construction, the Universal Portland Cement Co., 208 South La Salle Street, Chicago, will gladly furnish large blue prints of the plans illustrated, together with notes detailing construction requirements.



Figure 6. Concrete Septic Tank Similar to the Type Shown in Figure 2. This shows both compartments as they appear before placing the concrete roof or cover slab. Reinforcing rods from side walls are bent over to form part of the reinforcing for the cover.



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